

What is claimed is:

1. An apparatus for real-time modification of a natural scene for a human observer, said apparatus comprising:
 - 5 a camera for providing an image of the natural scene;
 - a digitizer coupled to said camera, said digitizer receiving said image and operative to provide a digitized image having a plurality of pixels of said natural image;
 - a plurality of digital filters each coupled to said digitizer to receive said digitized image of said image, each of said plurality of digital filters having a unique center frequency and each of said plurality of digital filters operative to provide a filtered digitized image;
 - 10 a threshold module coupled to said plurality of digital filters and receiving the plurality of filtered digitized images therefrom, for each of the plurality of filtered digitized images the threshold module operative to depict a pixel by a light scale when said pixel has an absolute value that is greater than a predetermined threshold and said pixel has a positive amplitude, to depict a pixel by a dark scale when said pixel has an absolute value that is greater than a predetermined threshold and said pixel has a negative amplitude, and depicting the remaining of said pixels in a gray scale;
 - 15 a contour module coupled to said threshold module and receiving said plurality of thresholded pixels, each corresponding to one of the plurality of filtered digitized images, the contour module operative to form a contour image by depicting a pixel in said contour image by a light scale if each corresponding pixel in each of the plurality of thresholded filtered digitized images is represented by a light scale,
 - 20 depicting a pixel in said contour image by a dark scale if each corresponding pixel in each of the plurality of thresholded filtered digitized images is represented by a dark scale, representing all remaining pixels as a gray scale, and providing a contour image of the thresholded filtered digitized image as an output.
2. The apparatus of claim 1 wherein said plurality of filters comprise oriented filters.
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3. The apparatus of claim 1 wherein said plurality of filters comprise spatial domain filters.
4. The apparatus of claim 3 wherein said spatial domain filters comprise spatial domain filters having an angular profile smoothed by a Gaussian multiplier.
5. The apparatus of claim 1 wherein said plurality of filters comprise discrete Fourier transforms.
6. The apparatus of claim 1 wherein said plurality of filters comprise wavelet transforms.
7. The apparatus of claim 1 further including a display module coupled to said digitizer and to said contour module, said display module operative to project said contour features onto said digitized natural image.
8. The apparatus of claim 7 wherein said display module includes a projection module and a semi-transparent screen, wherein said projection module projects said contour image and said digitized image onto said semi-transparent screen simultaneously.
9. The apparatus of claim 8 wherein said semi-transparent screen is part of a movie screen.
10. The apparatus of claim 8 wherein said semi-transparent screen is disposed in front of an eye of an observer.
11. The apparatus of claim 1 further including a magnification module coupled between said digitizer and said threshold module, said magnification module operative to change the magnification of said digitized image.

12. The apparatus of claim 11 wherein said image magnification is reduced, thereby minifying said digital image.

13. The apparatus of claim 1 further including a magnification module coupled
5 between said threshold module and said contour module, said magnification module operative to change the magnification of said digitized image.

14. The apparatus of claim 13 wherein said image magnification is reduced, thereby minifying said digital image.

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15. The apparatus of claim 1 wherein said camera is a video camera and said image is a video image.

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16. The apparatus of claim 1 wherein said camera is sensitive to the visual spectrum of light.

17. The apparatus of claim 1 wherein said camera is sensitive to the infrared spectrum of light.

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18. An apparatus for real-time modification of an image signal encoded with a natural scene for a human observer, said apparatus comprising:

a digitizer coupled to said image signal, said digitizer receiving said image signal and operative to provide a digitized image having a plurality of pixels of said natural image;

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a plurality of digital filters each coupled to said digitizer to receive said digitized image of said image, each of said plurality of digital filters having a unique center frequency and each of said plurality of digital filters operative to provide a filtered digitized image;

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a threshold module coupled to said plurality of digital filters and receiving the plurality of filtered digitized images therefrom, for each of the plurality of filtered digitized images the threshold module operative to depict a pixel by a light scale when

said pixel has an absolute value that is greater than a predetermined threshold and said pixel has a positive amplitude, to depict a pixel by a dark scale when said pixel has an absolute value that is greater than a predetermined threshold and said pixel has a negative amplitude, and depicting the remaining of said pixels in a gray scale;

5 a contour module coupled to said threshold module and receiving said plurality of thresholded pixels, each corresponding to one of the plurality of filtered digitized images, the contour module operative to form a contour image by depicting a pixel in said contour image by a light scale if each corresponding pixel in each of the plurality of thresholded filtered digitized images is represented by a light scale,
10 depicting a pixel in said contour image by a dark scale if each corresponding pixel in each of the plurality of thresholded filtered digitized images is represented by a dark scale, representing all remaining pixels as a gray scale, and providing a contour image of the thresholded filtered digitized image as an output;

 an encoding module coupled to said image signal and to said contour module,
15 said encoder module operative to form an enhancement signal by supplanting said image signal by identifying said portions of said image signal corresponding to said pixels in said contour image and modifying said image signal according to the degree of modification of the corresponding pixel in said contour image; and

 wherein said image signal and said enhancement signal are provided as
20 outputs.

19. The apparatus of claim 18 further including a mixer module coupled to said encoding module and operative to combine said image signal and said enhancement signal into a single signal.

25 20. The apparatus of claim 18 further including a magnification module coupled to said image signal wherein said output image signal is of a different magnification than said enhancement signal.

21. The apparatus of claim 20 wherein said magnification module is operative to magnify the original image, wherein an image corresponding to said image signal is magnified and an image corresponding to said enhancement signal is normal sized.

5 22. The apparatus of claim 18 further including a transmitter coupled to said encoder module and said image signal and operative to transmit said image signal and said enhancement signal.

10 23. The apparatus of claim 22 further including a mixer module coupled to said encoding module and to said transmitter, said mixer module operative to combine said image signal and said enhancement signal into a single signal and to provide said single signal to said transmitter for transmission thereby.

15 24. The apparatus of claim 22 further including a receiver coupled to said transmitter, said receiver including a decoder that decodes said image signal and said enhancement signal, said decoder operative to select between a portion of said image signal or a combination of said image signal and said enhancement signal for display.

20 25. The apparatus of claim 24 further including a display module coupled to said decoder and operative to display said portion of said image signal or said enhancement signal as selected by said decoder.

26. The apparatus of claim 25 wherein the display module is a television screen.

25 27. The apparatus of claim 24, wherein the receiver further includes a magnification module coupled to said image signal wherein said output image signal is of a different magnification than said enhancement signal.

30 28. The apparatus of claim 27 wherein said magnification module is operative to magnify the original image, wherein an image corresponding to said image signal is magnified and an image corresponding to said enhancement signal is normal sized.

29. The apparatus of claim 18 wherein said image signal is a television signal.

30. The apparatus of claim 29 wherein said television signal is an analog television signal.